

S/N 10/032,682

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Daniel P. Johnson

Examiner: Susanna Meinecke-Diaz

Serial No.: 10/032,682

Group Art Unit: 3692

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Docket: H0002678.34215

Title: GLOBAL EQUATION SOLVER AND OPTIMIZER

REQUEST TO REOPEN PROSECUTION UNDER 37 C.F.R. § 41.50(a)

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

This responds to the Decision on Appeal from the Board of Patent Appeals and Interferences mailed on May 27, 2008. Please amend and reconsider the above-identified patent application as follows.

This response is being filed within the two-month shortened-statutory period for response without requiring payment of any extension of time fee (including the time given under the weekend/holiday rule of 37 C.F.R. § 1.7).

This request to reopen prosecution is being submitted with a Request for Continued Examination.

IN THE CLAIMS

1. (Currently Amended) A computer-implemented method of solving an operations problem, the operations problem comprising a scheduling problem in a particular business operation, comprising:
 - receiving variables, relationships, and constraints relating to the scheduling problem;
 - forming a set of non-convex quadratic equations based on the variables, relationships, and constraints;
 - solving the set of non-convex quadratic equations by applying a bound propagation process, a local linear bounding process, a local linearization process, and a global subdivision search; and
 - determining whether a solution to the scheduling problem is optimal, feasible, or infeasible; and
 - when the solution is optimal and feasible, applying the solution to the scheduling problem to a manufacturing process to produce a manufactured product.
2. (Currently Amended) The method of claim 1, wherein the ~~solution is a schedule for a~~ manufacturing process comprises a manufacture of a food product.
3. (Currently Amended) The method of claim 1 ~~[[2]]~~, wherein the ~~solution is a schedule for~~ manufacturing process comprises operating an oil refinery.
4. (Currently Amended) The method of claim 2 ~~[[1]]~~, wherein the variables comprise one or more of an ingredient type, an ingredient amount, a temperature, and a process duration ~~solution is a plan for a manufacturing process.~~
5. (Currently Amended) The method of claim 3 ~~[[4]]~~, wherein the variables comprise one or more of a chemical agent, an amount of the chemical agent, a temperature, a pressure, a holding tank size, a flow rate, and a process duration ~~solution is a plan for operating an oil~~

refinery.

6. (Currently Amended) A machine-accessible medium having associated content capable of directing the machine to perform a method of solving a set of non-convex quadratic equations relating to a scheduling problem in a particular business operation, the method comprising:

selecting a region bounding all variables relating to the scheduling problem;

applying a bound propagation process to the region to refine the bounds and improve linearization;

applying a local linear bounding process to the region to determine feasibility and to find approximately feasible solutions to the scheduling problem;

applying a local linearization process to the region to determine feasibility and local optimality;

upon finding an optimal global solution to the scheduling problem, providing the optimal global solution and information indicating optimality;

upon finding a feasible global solution to the scheduling problem, providing the feasible global solution to the scheduling problem and information indicating feasibility;

upon determining local infeasibility, eliminating the region from consideration;

upon determining global infeasibility, providing information indicating infeasibility; and

upon not finding a solution to the scheduling problem, applying a global subdivision search to the region to produce two or more regions and iteratively applying the bound propagation, local linear bounding, and local linearization processes to each of the two or more regions, until determining the solution to the scheduling problem is optimal, feasible, or infeasible; and

upon finding the solution to the scheduling problem to be optimal or feasible, applying the solution to a manufacturing process to produce a manufactured product.

7. (Original) The machine-accessible medium as recited in claim 6, further comprising: receiving input variables, constraints, and equations.

8. (Original) The machine-accessible medium as recited in claim 6, further comprising:

receiving a measure of optimality used to determine the global optimal solution.

9. (Original) The machine-accessible medium as recited in claim 6, further comprising:
receiving a measure of feasibility used to determine the global feasible solution.
10. (Original) The machine-accessible medium as recited in claim 6, further comprising:
providing a schedule for operating a plant.
11. (Original) The machine-accessible medium as recited in claim 6, further comprising:
providing a plan for operating a plant.
12. (Currently Amended) A computer-implemented process of solving a set of non-convex quadratic equations relating to a scheduling problem in a particular business operation, comprising:
 - selecting a region bounding all variables relating to the scheduling problem;
 - applying a bound propagation process to the region to refine the bounds and improve linearization;
 - applying a local linear bounding process to the region to determine feasibility and to find approximately feasible solutions to the scheduling problem;
 - applying a local linearization process to the region to determine feasibility and local optimality;
 - upon finding a solution to the scheduling problem after the local linearization process, providing the solution;
 - upon determining infeasibility, eliminating the region from consideration; ~~and~~
 - upon not finding the solution to the scheduling problem after the local linearization process, applying a global subdivision search to the region to produce two or more regions and iteratively applying the bound propagation, local linear bounding, and local linearization processes to each of the two or more regions, until determining the solution to the scheduling problem is optimal, feasible, or infeasible; and
 - upon determining the solution to the scheduling problem is optimal or feasible, applying

the solution to the scheduling problem to a manufacturing process to produce a manufactured product.

13. (Original) The process as recited in claim 12, wherein the local linearization process is the local linear bounding process.

14. (Original) The process as recited in claim 12, wherein the local linear bounding process comprises:

- performing differentiation on equations in the region;
- determining lower and upper bounds on the variables in the region;
- applying a linear programming process to the linear equations in the region;
- determining whether a solution exists in the region;
- upon finding a solution exists, determining local feasibility; and
- upon finding local infeasibility, determining global infeasibility.

15. (Original) The process as recited in claim 12, wherein the local linearization process comprises:

- performing differentiation at a point in the bounded region;
- forming a set of linear equations;
- applying a linear programming process to the linear equations in the bounded region; and
- generating a new point in the bounded region and repeating the local linearization process with the new point.

16. (Original) The process as recited in claim 12, wherein applying a global subdivision search to the region to produce two or more regions comprises:

- maintaining a list of non-closed nodes;
- selecting a candidate set of nodes from the list;
- selecting a chosen node from the candidate set;
- subdividing a point range of the chosen node;
- closing the chosen node; and

opening two new nodes that subdivide the chosen node.

17. (Original) The process as recited in claim 16, wherein selecting the candidate set of nodes is done by selecting linearized nodes.
18. (Original) The process as recited in claim 16, wherein selecting the candidate set of nodes is done by expanding nodes that have not yet been partially expanded.
19. (Original) The process as recited in claim 16, wherein selecting the candidate set of nodes is done by selecting expanded nodes.
20. (Original) The process as recited in claim 16, wherein subdividing the two new nodes that subdivide the chosen node comprises:
 - subdividing a point range;
 - upon determining the chosen node is linearized and divergent, computing a worst divergence; and
 - upon determining the chosen node is not linearized, computing a dimension of largest infeasibility.
21. (New) The method of claim 4, wherein the food product comprises an ice cream product.

REMARKS

Claims 1-6 and 12 are currently amended, no claims are canceled, and claim 21 is added; as a result, claims 1-21 are pending and subject to examination in this application.

In the Decision on Appeal, decided May 27, 2008 (hereinafter "Decision"), the Board stated that:

1. Claims 1-5 and 12-20 do not recite and thus do not require computer implementation. (page 11)
2. Claims 1-5 and 12-20 seek to patent an abstract idea. (page 12)
3. Claims 1-5 and 12-20 do not transform any article to a different state or thing. (page 17)
4. The application of a law of nature or mathematical formula to a process may well be deserving of patent protection. p. 18.
5. Claims 1-5 and 12-20 make no mention of what or who is performing the receiving, forming, solving, and determining. p. 19.
6. Claims 6-11 cover every substantial practical application of the abstract idea. (page 20)

In response to the opinion of the Board dated May 27, 2008, the Applicant has amended the claims to recite that the claimed methods are computer-implemented methods. The Applicant respectfully submits that the recitation of a computer-implemented process addresses the rejection of the claims as being abstract, and further addresses the issue of what is performing the receiving, forming, solving, and determining features in the claims.

The Applicant has further amended the claims to limit the application of the recited features to a manufacturing process that produces a manufactured product. The Applicant respectfully submits that the application of the recited features to a manufacturing process that produces a manufactured product is a real world, tangible, concrete, and useful result.

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney at 612-371-2140 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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Date

July 25, 2008

By

David D'Zurilla
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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being filed using the USPTO's electronic filing system EFS-Web, and is addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this 25th day of July 2008.

Name

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